

We claim:-

JC20 Rec'd PCT/PTO 30 SEP 2005

1. A mixture of at least two compounds each having at least two double bonds, said mixture having a WFR from 240 to 600 g/mol of double bond and at least two of said compounds each comprising at least two (meth)acrylic esters as double bond component, WFR being given by:
 
$$\sum_{i=1}^n \alpha_i \times MW_i / Z_i = \text{WFR} \text{ where}$$

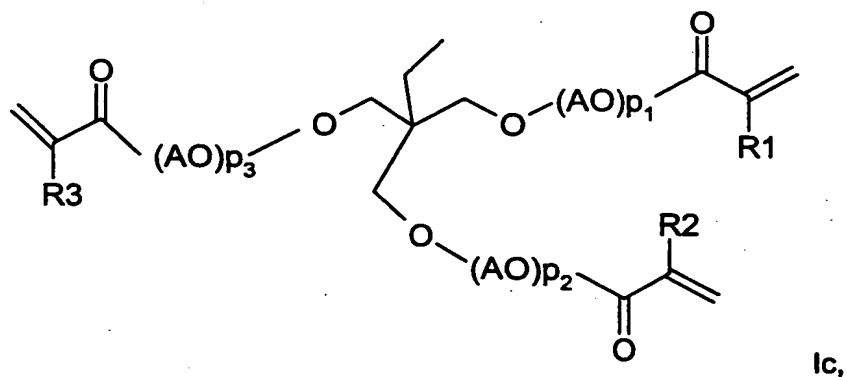
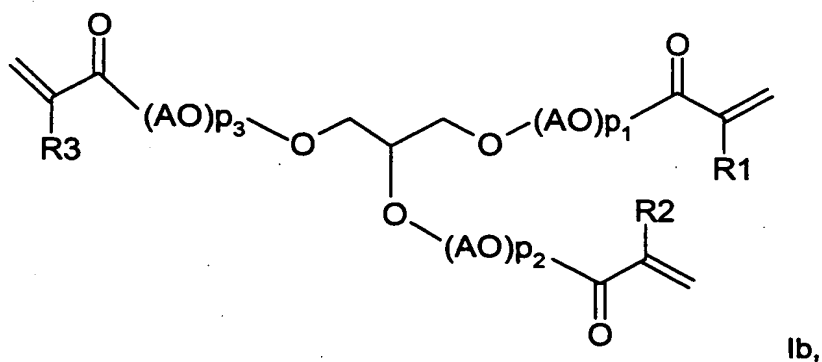
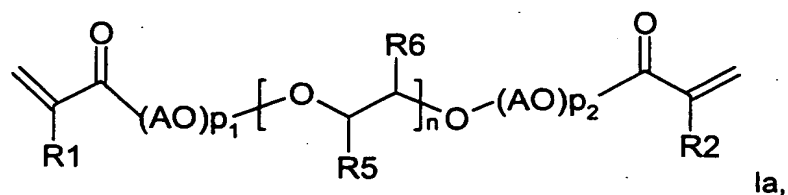
$$\sum_{i=1}^n \alpha_i = 1$$

$\alpha_i$  is equal to the molar fraction of compound (i) in said mixture;  
 $n$  is equal to the number of compounds in said mixture and  $n \geq 2$ ,  
 $Z_i$  is equal to the number of double bonds in said compound (i),  
 $MW_i$  is equal to the molecular weight of said compound (i).
2. The mixture according to claim 1 which has a WFR between 240 and 400 g/mol of double bond and preferably a WFR between 250 and 350 g/mol of double bond.
3. The mixture according to either of claims 1 and 2 wherein  $n$  is 2, 3 or 4 preferably 2.
4. The mixture according to any of claims 1 to 3 wherein the MW/Z ratios of two compounds differ at least by at least 50 g/mol of double bond, preferably by at least 100 g/mol of double bond and more preferably by at least 250 g/mol of double bond.
5. The mixture according to any of claims 1 to 4 wherein one compound has an MW/Z ratio of below 400 g/mol of double bond, preferably below 300 g/mol of double bond, more preferably below 200 g/mol of double bond and especially below 150 g/mol of double bond.
6. The mixture according to any of claims 1 to 5 wherein one compound has an MW/Z ratio of above 400 g/mol of double bond and below 10 000 g/mol of double bond and preferably of above 600 g/mol of double bond and below 1000 g/mol of double bond.
7. The mixture according to any of claims 1 to 6 wherein  $Z$  of at least one

AMENDED SHEET

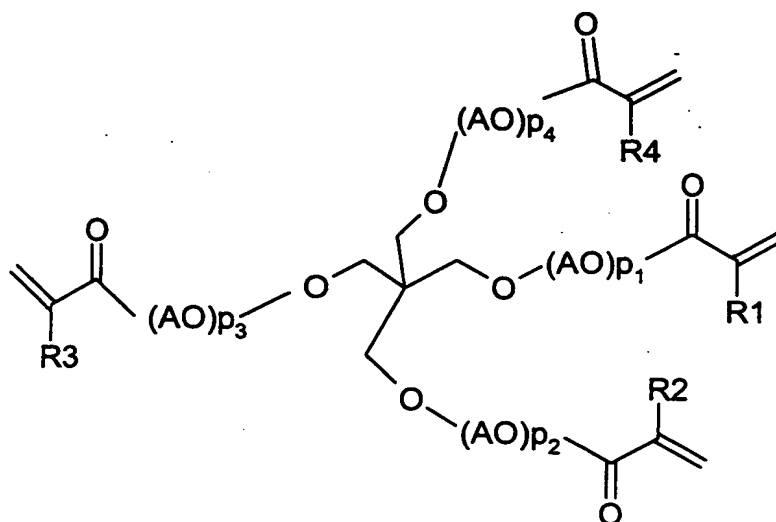
compound is between 2 and 6 and preferably is 2, 3 or 4.

8. The mixture according to any of claims 1 to 7 wherein said compounds are esters  $F_i$  which are obtainable by esterification of polyalcohols  $A_i$  with (meth)acrylic acid and each polyalcohol  $A_i$  has  $Z_i$  hydroxyl functions and from 2 to 50 carbon atoms.
9. The mixture according to any of claims 1 to 8 wherein one compound is represented by one of the following formulae:



or

73



Id

where AO is independently at each instance  $-O-CHR_7-CHR_8-$  or  $-CHR_7-CHR_8-O-$  where  $R_7$  and  $R_8$  are independently H, linear or branched C1-C8-alkyl,

$R_5$  and  $R_6$  are independently H, linear or branched C1-C8-alkyl,

$n$  is 1, 2 or 3

$p_1$  is 0, 1 or 2,

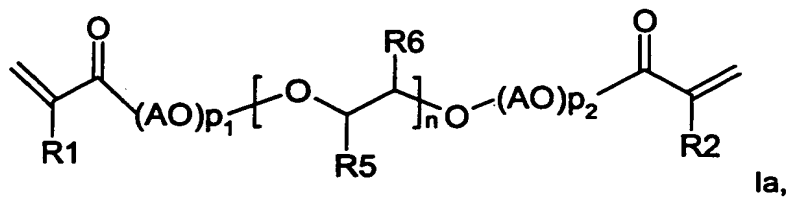
$p_2$  is 0, 1 or 2,

$p_3$  is 0, 1 or 2,

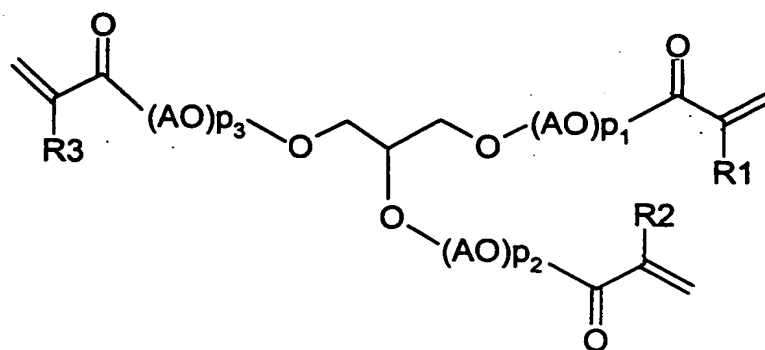
$p_4$  is 0, 1 or 2,

$R_1, R_2, R_3, R_4$  are independently H or  $CH_3$ ,

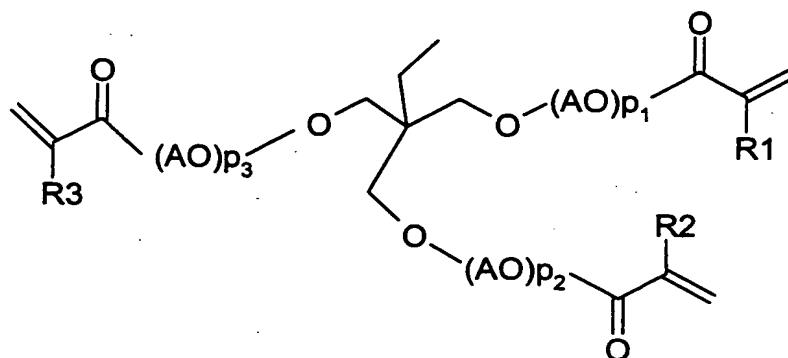
10. The mixture according to any of claims 1 to 9 wherein one compound is represented by one of the following formulae:



74



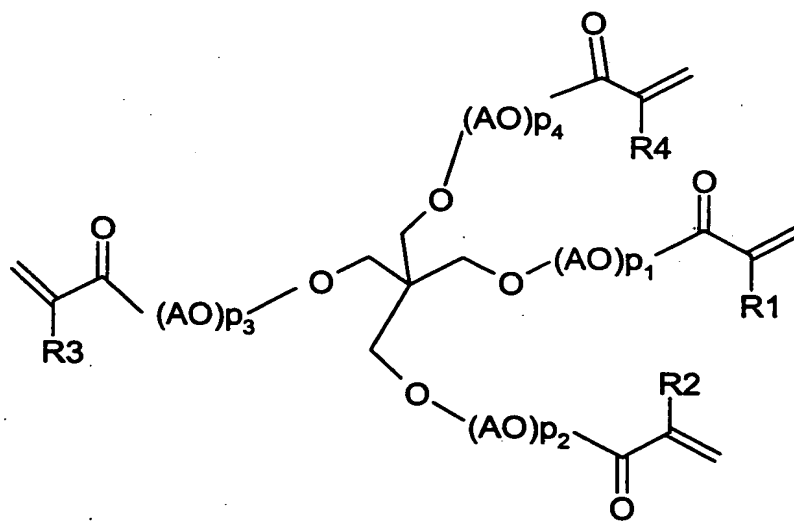
Ib,



Ic,

5

or



Id

10

where AO is independently at each instance  $-O-CHR_7-CHR_8-$  or  $-CHR_7-CHR_8-O-$ , where  $R_7$  and  $R_8$  are independently H, linear or branched C1-C8-alkyl,

$R_5$  and  $R_6$  are independently H, linear or branched C1-C8-alkyl,

AMENDED SHEET

n is 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 or 20,

p1 is 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 or 20,

5 p2 is 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 or 20,

p3 is 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 or 20,

10 p4 is 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 or 20,

R1, R2, R3, R4 are independently H or CH3.

11. The mixture according to either of claims 9 and 10 wherein AO is independently at each instance EO or PO,

15 where EO is O-CH<sub>2</sub>-CH<sub>2</sub>-,

PO is independently O-CH<sub>2</sub>-CH(CH<sub>3</sub>)- or O-CH(CH<sub>3</sub>)-CH<sub>2</sub>-

20 R5 and R6 are independently H or CH<sub>3</sub>

12. A process for preparing an ester mixture of said esters F<sub>i</sub> according to any of claims 1 to 11 by starting from an alcohol mixture of said polyalcohols A<sub>i</sub>, comprising the steps of

- 25 a) reacting said polyalcohols A<sub>i</sub> with (meth)acrylic acid in the presence of at least one esterification catalyst C and of at least one polymerization inhibitor D and optionally also of a water-azeotroping solvent E to form an ester mixture of said esters F<sub>i</sub>,
- 30 b) optionally removing from the reaction mixture some or all of the water formed in a), during and/or after a),
- f) optionally neutralizing said reaction mixture,
- h) when a solvent E was used, optionally removing this solvent by distillation, and/or
- 35 i) stripping with a gas which is inert under the reaction conditions.

13. The process for preparing an ester mixture of said esters F<sub>i</sub>, said mixture having a WFR from 200 to 600 g/mol of double bond or the process according to claim 12 wherein

- 40 - the molar excess of (meth)acrylic acid over said polyalcohols A<sub>i</sub> is at least 5\*Z<sub>i</sub> mol% and

- the optionally neutralized (meth)acrylic acid present in said reaction mixture after the last step substantially remains in said reaction mixture.
- 5 14. The process for preparing an ester mixture of said esters  $F_i$ , said mixture having a WFR from 200 to 600 g/mol of double bond or the process according to either of claims 12 and 13 wherein the (meth)acrylic acid is not more than 75% by weight removed from said reaction mixture obtained after said last step, which reaction mixture comprises ester mixture.
  - 10 15. The process for preparing an ester mixture of said esters  $F_i$ , said mixture having a WFR from 200 to 600 g/mol of double bond or the process according to any of claims 12 to 14 wherein said reaction mixture obtained after said last step, which comprises ester mixture, has a DIN EN 3682 acid number of at least 25 mg KOH/g.
  - 15 16. The process for preparing an ester mixture of said esters  $F_i$ , said mixture having a WFR from 200 to 600 g/mol of double bond or the process according to any of claims 12 to 15 wherein said reaction mixture obtained after said last step, which comprises ester mixture, has a (meth)acrylic acid content of at least 0.5% by weight.
  - 20 17. The process for preparing an ester mixture of said esters  $F_i$ , said mixture having a WFR from 200 to 600 g/mol of double bond or the process according to any of claims 12 to 16 wherein the molar ratio of (meth)acrylic acid to alcohol mixture  $A_i$  in reaction a) is at least  $5 \cdot Z_i : 1$ .
  - 25 18. A process for preparing a crosslinked hydrogel, comprising the steps of
    - 30 k) polymerizing an ester mixture of said esters  $F_i$ , said mixture having a WFR from 200 to 600 g/mol of double bond or esters  $F_i$  according to any of claims 1 to 11 with (meth)acrylic acid, with optionally additional monoethylenically unsaturated compounds N and optionally also at least one further copolymerizable hydrophilic monomer M in the presence of at least one free-radical initiator K and optionally of at least one further grafting base L,
    - 35 l) optionally postcrosslinking the reaction mixture obtained from k),
    - m) drying the reaction mixture obtained from k) or l), and
    - n) optionally grinding and/or sieving the reaction mixture obtained from k), l) or m).
  - 40 19. A process for preparing a crosslinked hydrogel, comprising steps a) to i) according to any of claims 12 to 17 and additionally

- 5 k) polymerizing the reaction mixture from one of stages a) to i) if performed, with optionally additional monoethylenically unsaturated compounds N and optionally also at least one further copolymerizable hydrophilic monomer M in the presence of at least one free-radical initiator K and optionally of at least one grafting base L,
- l) optionally postcrosslinking the reaction mixture obtained from k),
- m) drying the reaction mixture obtained from k) or l), and
- 10 n) optionally grinding and/or sieving the reaction mixture obtained from k), l) or m).
20. Polymer obtainable according to a process according to either of claims 18 and 19.
- 15 21. Crosslinked hydrogel comprising at least one hydrophilic monomer M in copolymerized form crosslinked with an ester mixture of said esters  $F_i$ , said mixture having a WFR from 200 to 600 g/mol of double bond according to any of claims 1 to 11.
- 20 22. Crosslinked hydrogel comprising at least one hydrophilic monomer M in copolymerized form crosslinked with a reaction mixture which comprises an ester mixture of said esters  $F_i$  and is obtainable according to a process of claims 12 to 15.
- 25 23. The use of a polymer according to any of claims 20 to 22 in hygiene articles, packaging materials and in nonwovens.
24. A composition of matter comprising
- 30 - from 0.1% to 40% by weight of at least one ester mixture of said esters  $F_i$ , said mixture having a WFR from 200 to 600 g/mol of double bond or esters  $F_i$  according to any of claims 1 to 11 and (meth)acrylic acid,
- 0.5 – 99.9% by weight of at least one hydrophilic monomer M,
- 0 – 10% by weight of at least one esterification catalyst C,
- 35 - 0 – 5% by weight of at least one polymerization inhibitor D, and
- 0 – 10% by weight of at least one solvent E,
- with the proviso that the sum total is always 100% by weight.
25. The composition of matter according to claim 24, further comprising
- 40 - a diluent G ad 100% by weight.

26. Crosslinked hydrogel obtainable from a composition of matter according to claim 24 or 25 and additionally
- 5      l) optionally postcrosslinking the reaction mixture obtained,  
      m) drying the reaction mixture obtained directly or obtained from l), and  
      n) optionally grinding and/or sieving the reaction mixture obtained directly or obtained from l) or m).
- 10 27. The use of a reaction mixture obtainable according to any of claims 12 to 17 or of a composition of matter according to claim 24 or 25
- 15      - as a free-radical crosslinker of water-absorbing hydrogels,  
      - as a starting material for preparing polymer dispersions,  
      - as a starting material for preparing polyacrylates,  
      - as a paint raw material, or  
      - as a cement additive.
- 20 28. The crosslinked hydrogel according to any of claims 20, 21, 22 or 26 which has a residual crosslinker content of less than 10 ppm, preferably less than 8 ppm and more preferably less than 5 ppm.
- 25 29. The use of an ester mixture of said esters  $F_i$  according to any of claims 1 to 11 for preparing hydrogel-forming polymers capable of absorbing aqueous fluids.
30. The use of an ester mixture according to claim 29 wherein each ester component  $F_i$  is present at less than 2% by weight and preferably 1% by weight based on the total amount of monomers.